A Dissertation on

"A COMPARATIVE STUDY ON VARIOUS APPROACHES IN THE SURGICAL MANAGEMENT OF VENTRAL HERNIA"

BY

DR V.GUHAN

DISSERTATION SUBMITTED FOR THE DEGREE OF MASTER OF SURGERY BRANCH-1 (GENERAL SURGERY) AT

MADRAS MEDICAL COLLEGE, CHENNAI.

THE TAMILNADU DR. M.G.R. MEDICAL UNIVERSITY,

GUINDY,

CHENNAI – 600 032.

APRIL 2016.

CERTIFICATE

This is to certify that, the dissertation entitled **"A COMPARATIVE STUDY ON VARIOUS APPROACHES IN THE SURGICAL MANAGEMENT OF VENTRAL HERNIA"** is the

bonafide work done by DR.V. GUHAN during his M.S. General Surgery course 2013 – 2016, done under my supervision and is submitted in partial fulfillment of the requirement for the M.S. (BRANCH 1) – GENERAL SURGERY of the Tamil Nadu Dr. M.G.R. Medical

University , April 2016 examination.

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DECLARATION

I, **Dr. V. GUHAN,** certainly declare that this dissertation titled **"A COMPARATIVE STUDY ON VARIOUS APPROACHES IN THE SURGICAL MANAGEMENT OF VENTRAL HERNIA"** represents a genuine work of mine. The contributions of any supervisors to the research are consistent with normal supervisory practice and are acknowledged. I also affirm that this bonafide work or part of this work was not submitted by me or any others for any award, degree or diploma to any other university board, either in India or abroad. This is submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the rules and regulations for the award of Master of Surgery degree Branch 1 (General Surgery).

Dr. V.GUHAN

Date:

Place:

ACKNOWLEDGEMENT

I hereby wish to express my heartfelt gratitude to the following persons without whose help this study would not have been possible.

I thank the Dean **Prof. Dr. R.Vimala, M.D**., for allowing me to conduct this study in Rajiv Gandhi Government General Hospital, Chennai.

My profound gratitude and sincere thanks to my chief **Prof. Dr. T.S. JAYASHREE, M.S.,** professor of surgery, the Institute of General Surgery for her guidance and supervision throughout my career and in carrying out this dissertation.

I am thankful to my Assistant Professors **Dr. J. Selvaraj, M.S., Dr. Ramadoss, M.S., Dr.Varun,M.S Dr.D.Tamilselvan, M.S.,** and **Dr.D.Manivannan, M.S.,** for their valuable advice, help and encouragement they rendered in the period of my study.

I sincerely thank my family, my colleagues and junior post graduates for their help and support. Last but not the least I thank all my patients for their kind co-operation in carrying out this study successfully.

Dr. V. GUHAN

INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

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CERTIFICATE OF APPROVAL

To
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Postgradaute M.S.(General Surgery)
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Dear Dr.Guhan V,

The Institutional Ethics Committee has considered your request and approved your study titled **"A comparative study on the various approaches in the surgical management of ventral hernia" No.18062015.**

The following members of Ethics Committee were present in the meeting held on 09.06.2015 conducted at Madras Medical College, Chennai-3.

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2 Prof R.Vimala, M.D , Dean, MMC, Ch-3	: Deputy Chairperson
3. Prof.B.Kalaiselvi, M.D., Vice-Principal, MMC, Ch-3	: Member Secretary
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12. Thiru S.Govindasamy, B.A., B.L.,	: Lawyer
13. Tmt.Arnold Saulina, M.A., MSW.,	: Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

Member Secretary, Ethics Committee

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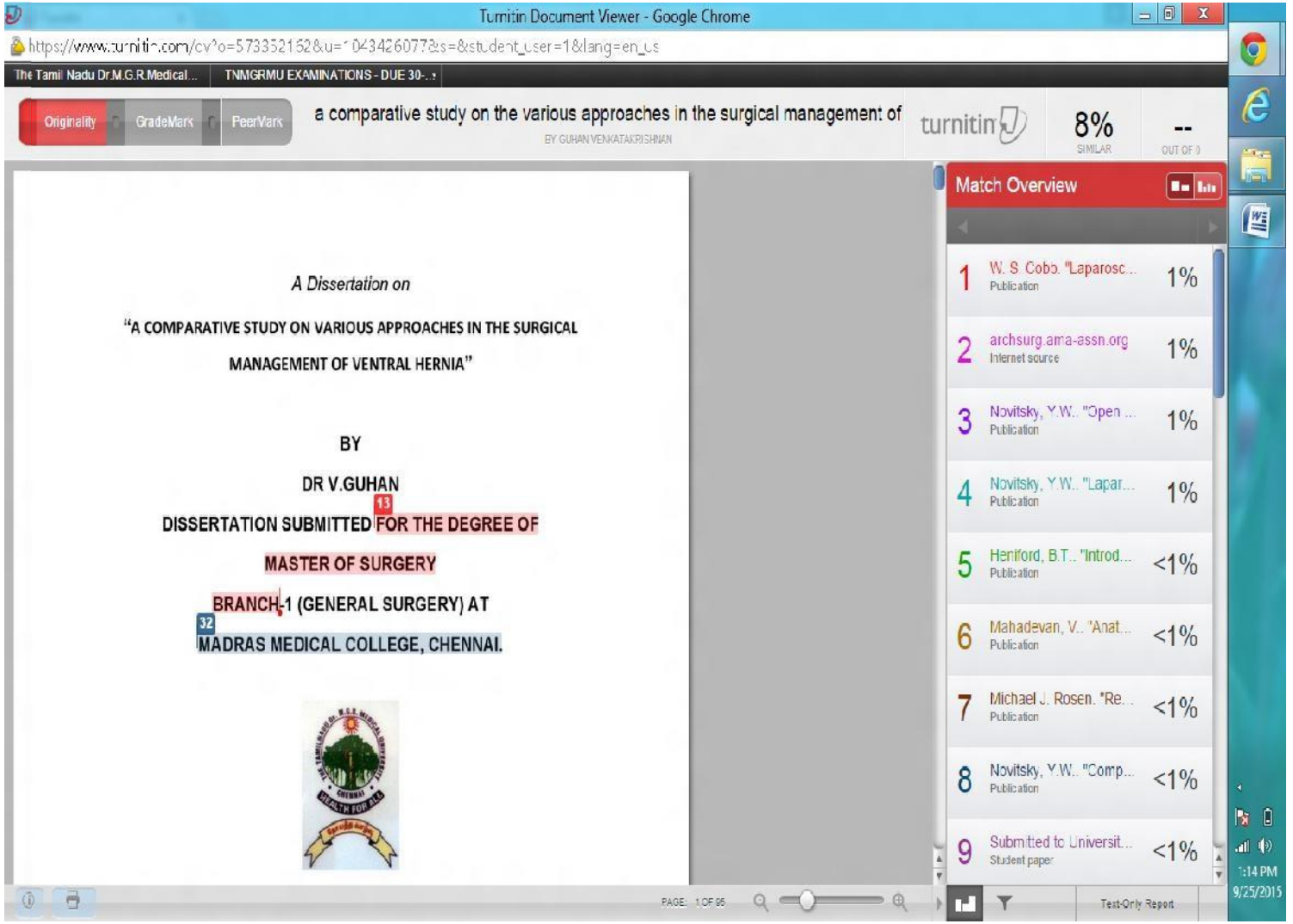
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ABSTRACT

‘A COMPARATIVE STUDY ON VARIOUS APPROACHES IN THE SURGICAL MANAGEMENT OF VENTRAL HERNIA’

AUTHOR: Dr. V. GUHAN

GUIDE: PROF T.S.JAYASHREE M.S.

INTRODUCTION:

Despite more than 200000 surgeries that is being performed every year for ventral hernias, there is no concrete evidence in the literature as to the indications for repair, the ideal approach, or the appropriate long-term outcome to determine success rates. With the different causes of ventral hernias, wide differences in defect sizes and locations and the associated medical comorbidities of every patient, it is not likely that a single approach to various ventral hernia repairs will ever be identified.

AIM OF THE STUDY:

To study and compare the various approach in the surgical management of ventral hernia namely onlay, sublay and laparoscopic intraperitoneal mesh repair.

MATERIALS AND METHODS:

60 patients presenting to Rajiv Gandhi Govt General Hospital between May 2015 to October 2015 and falling into selection criteria was randomized into three groups, one undergoing onlay mesh placement and other undergoing sublay placement of mesh and other undergoing intraperitoneal placement of mesh in ventral hernia surgery with equal number of patients in each group.All 3 groups were observed post operatively for day of ambulation, postoperative pain, seroma, wound infection, duration of hospital stay and followed up for return to work.

RESULTS:

In aspects of patient comfort and postoperative complications, laparoscopy is better than open methods. However it is associated with increased cost.

CONCLUSION:

Laparoscopic repair of ventral hernia is better when compared to open methods of repair.

KEYWORDS

Ventral hernia; mesh repair; onlay method; sublay method; intraperitoneal (laparoscopic) method.

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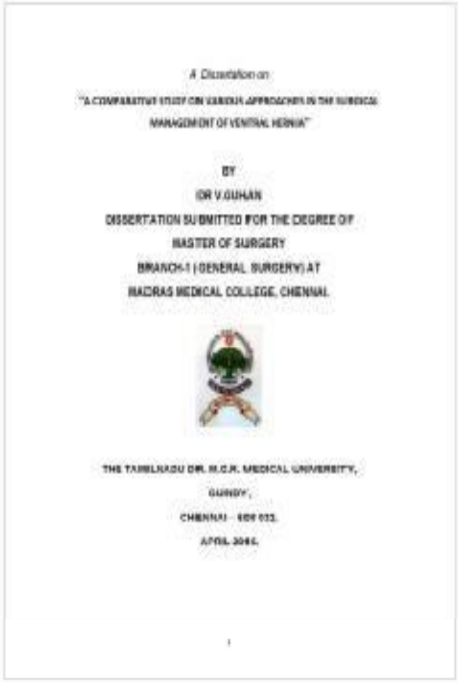

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CONTENTS

INTRODUCTION

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Despite more than 200000 surgeries that is being performed every year for ventral hernias, there is no concrete evidence in the literature as to the indications for repair, the ideal approach, or the appropriate long-term outcome to determine success rates. With the different causes of ventral hernias, wide differences in defect sizes and locations and the associated medical comorbidities of every patient, it is not likely that a single approach to various ventral hernia repairs will ever be identified.

With the advancement of time, changes in the management of ventral hernias is being attributed not only to the understanding of their origins but also in understanding failures of their repair. Sutured repair plays a vital role in herniorrhaphy, but **research has shown that suture repair may be subject to high recurrence rates even for small hernias. The use of prosthetic mesh for the reinforcement in a hernia**

repair has established a strong position not only in the repair of large or recurrent hernias but also in the repair of small primary repairs. The necessity for a strong prosthetic that is tolerated well and assimilated by the body is not a new idea. Industry recognized its worth in improving patient outcomes and in supply of materials for a constantly growing market.

Research in the area of prosthetic mesh has increased over the last decade with materials designed for placement both inside and outside the abdomen. **"nonstick" surfaces** mesh preformed for left or right sided laparoscopic inguinal hernia repairs and recently, the development of a huge number of biologic meshes is being made from the human and xenograft sources. **A perfect biomaterial currently is unavailable, but some very good and well-tolerated options are present.** There is little doubt that these options have helped to reduce the rates of recurrence and the morbidity in most common surgeries performed by surgeons .

Patients have to be evaluated on a case by case basis for the ideal approach taking into account the patient's age , comorbidities , the risk of surgical site occurrence, size of defect, and physiologic and functional status. The surgeon requires to have a broad armamentarium to identify these problems. In order to identify the ideal repair for each patient, the surgeon should understand the goals of the repair**. All hernia repairs at a**

minimum requires prevention of herniated bowel contents from becoming incarcerated in the defect which

must to be accomplished with less morbidity and a minimal recurrence rate. A patch type hernia repair is adequate for achieving this goal.

However certain patients benefits need extensive reconstructive approach with medialization of both the rectus muscles and to reconstruct the abdominal wall. The reconstructive surgeon must take all of these factors into consideration to provide a comprehensive approach to abdominal wall reconstruction.

This is a prospective study conducted at Rajiv Gandhi Government General Hospital, Chennai to determine which method whether open or preperitoneal or laparoscopic method is best.

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To study and compare the various approach in the surgical management of ventral hernia namely onlay, sublay and laparoscopic intraperitoneal mesh repair.

REVIEW OF LITERATURE

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HISTORY

"A hernia is defined as the protrusion of viscera from the abdominal cavity through a natural preformed anatomical route while an incisional hernia indicates the protrusion of viscera from the abdominal cavity through a route formed after trauma induced by cutting (surgical incision laparascopic trocar puncture wounds stab wounds).

For a long time, the term **eventration** was reserved for serious abdominal wall damage whereas according to Quenu real eventration was that due to pregnancy and post operative eventration was what we now call incisional hernia. This concept was expanded when modern abdominal surgery started at the end of the nineteenth and beginning of the twentieth centuries. It was in this period that cases of postoperative eventration appeared and gradually increased in number while at the same time surgical techniques, aimed at their correction developed and multiplied".

"The evolution of surgical techniques has followed the progress of research and the development of technology. Consequently the

possibility of prosthetic repair initially with metal prostheses and later with synthetic ones was considered. The positive results of these techniques were essentially the outcome" "of knowledge of the particular physiopathology, with particular attention given to the traction exerted on the linea alba by the large muscles of the abdomen .

Even though numerous case studies of surgically treated eventration were published early on the history of specific surgical treatment of incisional hernia began in the second half of the 1800s. Before that, surgeons used exclusively restraining methods. Surgical treatment or, to use the less elegant term coined by several authors, bloody treatment, developed along three lines: **(1) simple laparoplasty, (2) organic auto or heteroplasty and (3) alloplasty.** Simple laparoplasties were carried out according to Gosselin's anatomopathological and clinical descriptions . In the beginning, suturing of the wall defect breach was carried out transcutaneously on a closed abdomen".

"Successively between 1880 and 1900 aponeurotic suturing techniques on one or more planes, with or without opening of the

peritoneum, were introduced and increased in number. **In 1972 De Franchis published a report on incisional- hernia surgery that was considered to be a reference point due to its abundant bibliographical data and its descriptions of the various surgical techniques used in the treatment of incisional hernia**. These were based on what is considered as the cornerstone of abdominal-wall reconstruction that" is "aponeurotic suturing. Consequently techniques based on layer suturing, according to Quenu or on mass suturing according to Le Dentu were carried out.

In 1896 Quenu described the suturing of several layers adjacent to the incision of the rectus muscle sheath and along its medial margin suturing of the posterior face of the sheath of one rectus muscle with the posterior face of the contralateral one and suturing of the muscle edges preceded by suturing of the anterior face of the two rectus muscles. This technique was particularly recommended in cases of diastasis of the rectus abdominis muscles. In reality this method represented an autoplasty through the use of the lamina anterior and posterior musculi recti abdominis".

"During the next stage in the evolution of a surgical approach to treating incisional hernia plasty was proposed using U shaped muscle

aponeurosis suture stitches or 8 -shaped stitches through the entire thickness . These and other techniques were advocated with the aim of obtaining abdominal wall reconstructions that would radically and definitively eliminate the pathology of incisional hernia. Some authors focussed their efforts on incisional hernias situated in specific areas. Schulten dedicated his research efforts to umbilical-pubic incisional hernias".

" Regarding treatment of the peritoneal sac while some surgeons currently recommend its resectioning others advise its breakdown with puckering by means of a few catgut stitches . It is obvious that these techniques cannot be carried out in a generalised manner as some sacs of not recent formation multilocular sacs and those adhering to the viscera they contain must necessarily be resected while others without any particular adherences to the herniated viscera can be suppressed".

"**The most common and most frequently adopted autoplasty is still the one described by Mayo in 1901 which is based on**

overlapping. He developed the idea of making an overlap of the muscle aponeurosis planes, the commonly defined waistcoat plasty for the treatment of umbilical hernias. This procedure was further modified by Judd in 1912 consists of overlapping one lip of the

walldefect breach with the opposite lip in order to double the thickness of the wall in that place. The edge of the lip that remains underneath is fixed by several U stitches at a certain distance from the edge of the overlapping lip. The edge of the peritoneal face of the lip that is overlapped is sutured to the underlying aponeurotic surface with a fine overcast suture". This technique is still frequently used, particularly in lateral and subumbilical incisional hernias.

" In 1941 Welti accomplished an autoplasty based on uncovering the right rectus major abdominis. This was stripped with two longitudinal incisions after the linea alba had been incised. The medial margin of the two incisions was then sutured to the left edge of the linea alba leaving the rectus muscle, still uncov- ered, to become medial and to act as a barrier anterior to the wall-defect area, that determines the definite healing of the eventration. This technique was partly modified by the debulking incisions of Clotteau and Premont Gibson and Albanese .

The techniques of auto and heterotransplant of the fascia lata skin grafting or of skin cut into small plastic like strips have also been applied in the treatment of incisional hernias of small dimension. The use of skin grafts, above or below the aponeurosis but preferably above it developed from 1940 onwards along the lines proposed by Loewe in 1913 even though the appearance of epidermoid cysts was reported. In order to avoid them, Grassi advocated using the dermis under traction due to its greater capacity to merge with the surrounding tissues".

" Besides the use of aponeurotic or cutaneous tissue for auto and heteroplasty cartilaginous periosteal muscular decalcified bone meningeal as well as autologous and heterologous tissues have been proposed. In all of these cases there is a more or less abundant production of reactive fibrous tissue that constitutes a very valid protective framework.

Some of the inconveniences and, above all, the need to repair extensive walldefect breaches led to the use of alloplastic material. **Accordingly the age of alloplasty can be divided into two periods: (1) metals and (2) inert synthetic materials.** The first proposal to use metallic materials dates back to the beginning of 1900, when Shipley

used metal wires which he tied on the skin, tightening the knot around common buttons. Gold was used as well but in order to reduce the costs other filigrees aluminium and alloys such as brass were turned to. These prostheses were badly tolerated and provoked violent tissue reactions so their use was discontinued".

"Just when it seemed that the period of metals was about to die out, new possibilities arose with the appearance of tantalum and stainless steel. Tantalum in particular, demonstrated good tolerability and solidity. Moreover it also stimulated a favourable proliferation and invasion of connective tissue with" "results that were generally considered good as long as the anatomical formations were perfectly reconstructed the material was kept away from fatty tissue, a thorough haemostasis was carried out fixing sutures were applied exactly and perfectly and maximum sterility was respected in order to avoid, as far as possible the formation of haematomas haemorrhagic infiltrations, seromas and suppurative complications . Relapses were rare . The same cannot be said for stainless steel, whose only difference with earlier metallic meshes was its lower cost" .

"After 1940 the use of prostheses increased as the development and manufacture of plastic materials progressed leading to surgical applications of inert synthetic materials. Initially many practitioners

turned to the use of nylon. In 1949 Michaux recommended sectioning nylon with a cautery knife so as to avoid fraying of the edges. However this precaution was refuted in 1951 by Testa who demonstrated experimentally that the nylon border not only becomes rigid with this treatment but stimulates an intense dangerous and excessive fibrous proliferation in the subcutis and perimysium.

This occurred to an even greater degree when catgut was used so other types of suture were recommended. **Stock suggested the application of a nylon mesh between the peritoneum and the muscle layer.** Bourgeon reported" "that the mesh could also be applied intraperitoneally and fixed to the aponeurotic muscle plane with single sutures since as early as 8 post operative days it became fastened to the fibrous exudate serosa and after 2 months was covered by a tissue with the same aspect as the peritoneum.

Similar effects were obtained with orlon and very good results with the use of dacron particularly in peristomal incisional hernia ivalon and teflon. It is of note that the number of case histories with no relapses increased and all authors stated that patients could be out of bed quickly, even in cases of post-operative eventration. By contrast regarding the

above mentioned peristomal incisional hernia the use of marlex mesh resulted in frequent relapses".

"In recent times due to the progress made in the chemical industries numerous kinds of synthetic prostheses have rapidly appeared on the market and while some of them have been short lived others have become progressively well established. This succession has included nylon dacron teflon ivalon velourlined silicone and above all polytetrafluoroethylene (PTFE), the latter reducingthe formation of adherences. **Mersilene which was introduced in France by Rives is the material of choice for most French surgeons, while in the**

United States surgeons generally prefer marlex (polypropylene). The last" "three materials better respond to the needs of surgery in the repair of incisional hernias. ***This was stressed by Arnaud who in 1977 stated that a prosthesis must not be toxic must last in time and must be flexible and resistant and must have the right strength and provoke minimal tissue reaction.***

In recent times with progress in surgical techniques, the number of cases of limited sized incisional hernia treated by laparoscopy has increased. After freeing the viscera adhered to the incisional hernia sac a Gore Tex

mesh is applied to the peritoneal surface and fixed with a few sutures or with special synthetic material clips".

DEFINITIONS

The term ***ventral hernia*** is described as any protrusion of the abdominal viscera most often a piece of intestine through a defect in the anterior abdominal wall.

Ventral hernias are subdivided into two categories

· Spontaneous (or primary) hernias and ·

Incisional hernias

They can be further classified by location.

Subxiphoid hernias are located just inferior to the xiphoid process. ***Epigastric*** **hernias** overlap this area, but also includes spontaneous herniation through the linea alba down to the umbilicus. ***Umbilical*** **hernia** is a class of spontaneous or congenital ventral hernia which is located at the umbilicus. *Hypogastric* hernia, spontaneous hernia inferior

to the umbilicus, is rare. *Suprapubic* and *parailiac* hernia occurs along the pelvic brim adjacent to the bony prominences.

***Spigelian* hernia** is a spontaneous herniation which occurs along the semilunar line. *Traumatic* herniation can occur almost anywhere on the anterior abdominal wall where the fascial planes are disrupted by blunt or a penetrating abdominal force. ***Incisional hernias* refer to any herniation of abdominal contents through a previous surgical incision in anterior abdominal wall.**

Apart from the ventral hernias, there are two entities of anterior abdominal wall which appears to have a herniation but actually does not. ***Eventration*** of the anterior abdominal wall is a bulge that occurs from the paralysis of a part of the abdominal musculature or due to the congenital absence. When there is not a definable hernia sac or a fascial defect, a bulge results from lack of muscle tone. ***Diastasis recti*** is manifested as midline bulge where linea alba is broadened or stretched which causes medial margins of rectus abdominis muscles to separate. There is no hernial sac or fascial defect and majority are completely asymptomatic.

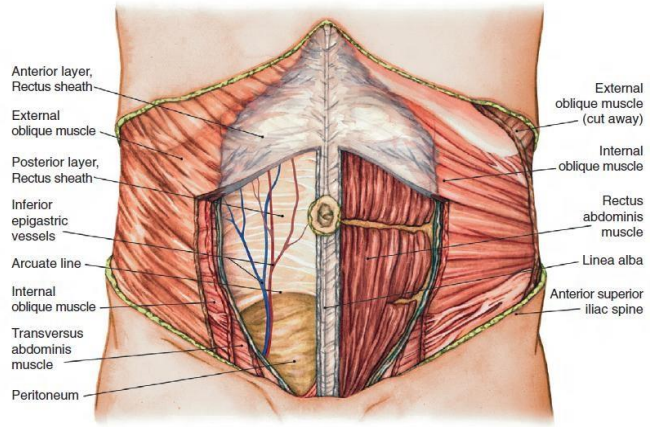
If a patient with diastasis presents with significant symptoms the abdominal wall should be reconstructed, but this requires a relatively complex procedure. Irrespective of the cause of a ventral hernia it can also be defined as loss of tendinous insertion of linea alba. Like a tendinous transection in the forearm, the lateral oblique also tends to atrophy and fibrose. If the reconstruction of the abdominal wall does not involve reestablishment of the tendinous insertion, this weakness cannot be reversed. This concept contradicts the theory that a "tension-free" abdominal wall closure is necessary for restoring abdominal wall function. Instead the appropriate approach for abdominal wall reconstruction involves to restore the adequate physiologic tension onto the anterior abdominal wall by recreation of linea alba.

ANATOMY

The anterior abdominal wall is made of a complicated layering of muscles aponeuroses and fascia. **The obvious feature is the umbilicus that represents the cicatricial remnant of the former umbilical cord and vessels**. It lies at the midpoint between xiphoid process and pubis, but varies depending on amount of subcutaneous adipose tissue. The midline further is defined by the linea alba, which extends from the xiphoid process to the symphysis pubis. It is located between the medial

borders of the rectus muscles and seen as a linear furrow in the anterior abdominal wall of muscular patients.

The linea alba is composed of dense crisscross fibrous bands formed from the uniting aponeuroses of the external oblique internal oblique and transversalis muscles from both sides of the anterior abdominal wall. It begins broad at the xiphoid, measuring 1cm to 2.5 cm, as the rectus sheath fibers diverge to insert on the fifth sixth and seventh costal cartilages. Below the level of umbilicus, the linea alba narrows to a thin line between the recti muscles as it inserts on to the symphysis pubis. Several tendinous intersections extend from the linea alba medially to the lateral rectus sheath border, the linea semilunaris, which by so firmly adheres the rectus abdominis muscles to the anterior rectus sheath.



The rectus abdominis muscle forms the central anchoring muscle of the anterior abdominal wall. The rectus sheath is a complicated weaving of aponeuroses from the flat anterior abdominal muscle and is composed of two layers that surrounds the rectus abdominis muscles.

The anterior rectus sheath is formed by the blend of the external oblique muscle aponeurosis and the anterior lamina of the internal oblique muscle aponeurosis. The posterior rectus sheath is usually formed by the posterior lamina of internal oblique and transversus abdominis aponeurosis. Midway between the umbilicus and the pubis, the three aponeurotic layers fuses with each other to form one anterior sheath which is known as the **arcuate line** which marks the inferior border of the posterior sheath. The spigelian fascia is a aponeurosis which is formed by fusion of the internal oblique and transversus abdominis aponeurosis. It extends from the cartilage of eighth rib to pubis, medial to the semilunar line and just lateral to the edge of the rectus abdominis muscle. Below the level of the umbilicus, the fibers of this aponeurosis run in parallel fashion making it susceptible to separation.

The spigelian fascia is weakest at the level of the semicircular line of Douglas. The inferior epigastric vessels also contribute to the weakness of this area by traversing the posterior aspect of rectus

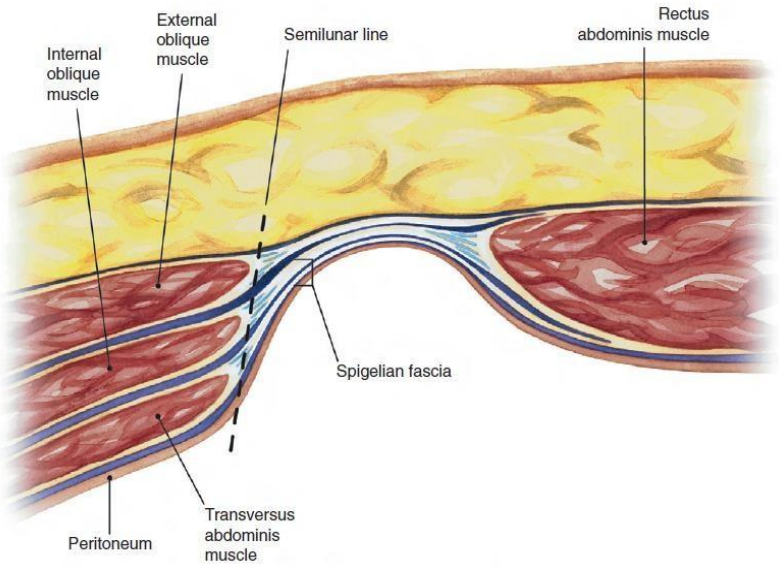
abdominis. A **spigelian hernia** is a defect in the abdominal wall, with the preperitoneal fat or peritoneal sac which protrudes through the internal oblique but remains posterior to the external oblique aponeurosis**. A spigelian hernia can occur anywhere along the semilunar line. 90% of hernias occur in the spigelian *belt*, a 6-cm area of aponeurosis extending cranially from the line between two anterior superior iliac spines.** This weak region of the spigelian fascia is bounded laterally by the semilunar line, medially the inferior epigastric vessel and arcuate line superiorly.

The lateral abdominal wall made of three layered flat muscles. The external oblique is the most superficial muscle which courses inferiorly from its lower costal origins to its insertion on the iliac crest and it forms **the inguinal ligament**, and medially fuses with the internal oblique. Below that layer is the internal oblique muscle which originates from the lateral half of the inguinal ligament fans out following the shape of iliac crest with superior fibers coursing upward toward the lower three or four ribs the fibers of which forms the superficial part of the deep inguinal ring. The innermost muscle layer the transversus abdominis courses horizontally and joins medially the internal oblique aponeurosis. Similar

to the internal oblique, many inferior fibers account to the inguinal region.

The preperitoneal space divides the deep fascia layer from the peritoneum and contains fat more prominent in the lower part of abdomen. The blood supply of anterior abdominal wall is obtained from numerous sources. The upper part of abdomen is supplied mainly by **the superior epigastric artery** and the terminal branch of internal thoracic artery along with collateral branches of the lower intercostal arteries. The lower part of abdomen receives blood supply mainly from **the inferior epigastric and deep circumflex iliac arteries which are branches of the external iliac vessels**. The superior and inferior epigastric vessels anastomose with each other deep to the rectus abdominis muscle.

Nerves which supply anterior abdominal wall run inbetween the internal oblique and transversus abdominis muscles. These nerves pierce superficially through rectus sheath thus forming anterior cutaneous nerves. Branches that are originating from the lower thoracic nerve roots (T7-T9) supply the area superior to umbilicus, T10 innervates the periumbilical skin, and T11-L1 innervates infraumbilical area.



ETIOLOGY

The formation of ventral hernia is multifactorial and complicated. The three well recognized causes of ventral hernias are congenital, incisional and spontaneous. Congenital hernias which are present at birth are most often treated during the pediatric period of life itself. As previously stated, incisional hernia is a hernia of the anterior abdominal wall which occurs through a previous surgical inicision.

Ventral hernias which are most commonly found along the linea alba are *spontaneous*. Though they are mostly supraumbilical in location, but

they can occur anywhere along linea alba, and more than one herniation may also be found. The interlacing fibers of the aponeuroses of this portion of the linea alba are pierced by small blood vessels and nerves through the openings of which extraperitoneal areolar tissue may herniate and may produce an epigastric hernia.

The hernial opening is usually 1 cm in size or even smaller and is often asymptomatic. Protrusion of extraperitoneal fat may or sometimes may not be accompanied by a sac of subjacent peritoneum. It is usually referred to as lipomas, the fatty tissue is not described a tumor. It is a mushroom like mass of preperitoneal encapsulated fat along with a feeding artery that usually comes through a small, tight defect. When a sac is present, it is usually small and barely protrudes through the fascial opening which does not become apparent unless the surrounding preperitoneal fat is removed completely. Small epigastric hernias generally increase in size very slow as the fascial ring through which they protrude is tough and unyielding. If a larger sac is present, contents may be omentum intestine and other viscera.

Umbilical hernia is another example of spontaneous ventral hernia and is common in the adult population. Rarely these umbilical hernias can occur from recurrence or persistent congenital umbilical herniation.

But in 90% of patients it is acquired and is directly a result of chronically increased intraabdominal pressure**. Various factors have been attributed to the raised intraabdominal pressure including multiparity obesity and cirrhosis with ascites.** Umbilical hernia tends to be more common in females and often develops in the fourth or fifth decade of life.

The fascial ring which constitutes the neck of the hernia can be dense and is usually formed by gradual yielding of cicatricial tissue covering the umbilical ring. In children less than 2 years most of the umbilical hernias close spontaneously. But in adults these tend to enlarge with time. Numerous patient related factors few of which are controversial may lead to formation of ventral hernias as well as recurrence. These include obesity, old age, male gender, smoking, emphysema, obstructive sleep apnea and chronic lung conditions abdominal distention, steroids, prostatomegaly and jaundice. Data suggests that certain defects in biochemical process including **collagen deficiencies** may lead to a raise in rate of both aneurysmal disease and hernia formation. These defects in collagen formation are responsible for a higher rate of incisional hernia formation after aortic surgery and also in spontaneous abdominal wall hernias.

Incidence of incisional hernia in laparotomy incisions ranges from 2% to 36%. Technical factors including slippage of knots, suture fractures, excessive tension, or rapidly absorbable sutures, may also result in an excess rate of incisional hernias**. A surgical site infection at the time of previous surgery doubles the risk of herniation.** The best closure method for midline abdominal incisions is being evaluated in numerous trials and still lacks a clear consensus among surgeons.

The ideal suture material must retain high tensile strength until clear cut wound healing occurs and a monofilament suture material to prevent bacterial attachment to the fibers. Also, evidence suggests that permanent suture serves as a potential nidus of infection. **Midline closure of abdomen incision by continuous, rapidly absorbable suture material resulted in a statistically higher percentage of incisional hernias when compared with closure by either continuous slowly absorbable suture or non absorbable suture.** Even though results from closure by continuous slowly absorbable suture versus non absorbable suture were not statistically significant, patients with non absorbable suture had increased suture sinuses.

No significant difference was noted on comparing continuous and interrupted closure methods except that continuous closure is more

expeditious but there was nil difference in hernia formation. PDS has the lowest overall rates of recurrence.

A continuous, slowly absorbable fascial closure leads to the lowest incidence of incisional hernia. On the role of suture length on hernia recurrence and in wound infection was found that **a stitch of length four times the length of the wound and bites of only 5 to 8 mm from the wound edge decreased the percentage of incisional hernia formation from 18% to 5.6% and the percentage of surgical site infection from 10.2% to 5.2%** when compared with conventional closure techniques. It is recommended that the method of incision should be based on surgeon preference and also the procedure planned.

As laparoscopic technique has become popular in all aspects of abdominal surgery, it appears that at least the complexity if not the incidence of ventral hernias would be decreased. Laparoscopic trocar site hernia is common and occurs at a percentage of 0.6% of 2.8%. Fascial defects that are larger than 5 mm must be closed in adults. Some argue that dilating non cutting trocar sites up to 10 mm need not be closed with suture.

A recent review evaluating these ports shows a 0.66% hernia rate in 12 mm radially dilating, non cutting trocars, supporting the closure of

these ports with suture. Regardless of the length of the incision, infection poor tissue healing increased abdominal pressure and other factors can lead to formation of a hernia. Closing only the anterior fascia can result in the rare Richter or preperitoneal hernia that can be difficult to diagnose without laparoscopy or laparotomy.

SYMPTOMS

Ventral hernia is noticed by the patient as a bulge in the anterior abdominal wall. They can be exagerrated by any action that raises intra abdominal pressure including coughing performing a Valsalva maneuver lifting weights or by elevation of the head or legs. Occasionally patients reports pain or discomfort associated with their hernia which often resolves with rest or reduction of incarcerated hernia. But this relief is only temporary. Smaller hernias are frequently asymptomatic or may produce occasional complaints. Discomfort or a ventral bulge is the most common initial symptom but bowel

obstruction can also be the first symptom that needs the patient to seek medical attention. Incarceration and strangulation is more common if the hernia neck defect is small so that it makes reduction of the hernia contents difficult.

INDICATIONS FOR SURGERY

Abdominal wall hernia in adults does not spontaneously heal or close and almost all enlarge time progresses. In majority of patients if they are an ideal surgical candidate the presence of a hernia itself is an **indication for repair and it allows for the potentially dangerous sequelae of incarceration obstruction or strangulation to be avoided.** Pain and limitations of daily activities are the most important indications for repair whereas cosmetic complaints are seen as least important. Nearly 25% of repairs are performed in asymptomatic patients in an attempt to avoid serious consequences. As stated, hernias tend to increase in size over time therefore delaying repair will often make it more complicated.

PREPARATION

A complete patient evaluation consists of thorough history and physical examination. **Pulmonary and cardiac co-morbid conditions diabetes and other medical problems need to be identified** and addressed to. The physical examination would be straightforward in patients who have hernias with well defined fascial borders. A computed tomography scan can also be helpful if the presence of a hernia is debatable such as in an obese patient and if it is located in an unusual location or if there have been several failed attempts at repair of the herniation. Patients must be

interrogated for any symptoms of incarceration such as pain nausea vomiting and constipation**. As much information as possible about the previous operations must be obtained from the patient including the type of surgery and about the postoperative wound complications.**

If the patient has recurrent hernia, information regarding the size and location of the original hernia, and the type and location of any prosthetic mesh used must also be obtained. Obese patient has a higher risk for recurrence and should be considered for weight-loss methods or counseling should be given before or around the time of hernia repair.

However the majority might not be able to lose weight. Smoking is a contraindication for complex abdominal wall reconstruction as it has been linked to unacceptably incresed rates of wound morbidity and hernia recurrence.

At the time of surgery, patients must receive secondgeneration cephalosporin, and should be dose adjusted to patient weight and should be repeated if the operation lasts longer than 4 hours. Compression stockings or other form of deep venous thrombosis prophylaxis is highly recommended. Placing a gastric or bladder catheter should be optional depending on the operative location length of surgery and the extent of intestinal manipulation.

PROSTHETICS

SYNTHETIC

Prosthetic mesh products have changed the repair of ventral hernias and their use is recommended for the majority of hernia surgeries. The characteristic of an ideal prosthetic was popularized by Cumberland and Scales. **They include chemical inertness, resistance to mechanical stress, pliability, lack of physical modification by the body tissues, capability of sterilization, nil carcinogenic potential, limited inflammatory or foreign body reaction, and hypoallergenic nature of prosthetic.** No prosthetic has been able to attain all the properties. The first prosthetic mesh used was metallic and made up of tantalum gauze and stainless steel mesh. Widespread use of metallic mesh was limited for various reasons. It includes lack of flexibility fatigue fractures with subsequent herniation through the fractures or migrating fragments result in fistulas loss of structural integrity and the need for abdominal wall resection if these materials became infected.

In 1958, Usher et al reported on the newly developed **polypropylene mesh (Marlex)** the introduction of which was a major landmark in prosthetic mesh. In current days, most of the prosthetic meshes are derived from either polypropylene or polyester or

polytetrafluoroethylene (PTFE). Despite changes being made in the backbone of prosthetics advances in manufacturing and design has led to multiple advances in the mesh. The first polypropylene mesh was considered heavyweight and became the standard mesh used

worldwide. It was designed with large pores that allowed for ingrowth of native fibroblasts but it can induce an inflammatory reaction which causes scarring fibrous encapsulation and limit incorporation into surrounding fascia.

The abdominal wall can become stiff or exhibit decreased compliance and **the mesh prosthetic shrinks nearly 30% to 50%.** The decrease in compliance can lead to sensation of stiffness and discomfort in most patients. Also, areas of the abdominal wall which have previous incisions but without mesh coverage may experience an increase in herniation as the abdominal pressure is not distributed evenly. **Because of the tendency for severe intestinal adhesions, ingrowth, fistulization and scarring around the mesh it is not recommended for use of mesh in an intraabdominal location.**

When placed against the intestine the development of

enterocutaneous fistulas and bowel obstructions is well documented and may occur in more than 2% of patients. **Newer modifications of polypropylene mesh are present with reduction in mesh weight and density.** This is achieved through an increase of pore size or adding an absorbable component to the weave. Whether this reduced weight polypropylene mesh results in long term durability of hernia repair remains confusing. Lightweight polypropylene has various advantages.

As the amount of polypropylene decreases and pore size increases, compliance of the abdominal wall improves. However questions have been raised whether these light weight mesh is prone to central failures and mesh fractures.

Polyester mesh is supple has grainy texture and induces a rapid fibroblastic tissue response. The supple handling property of the mesh allows it to conform easily to curvatures of the abdominal wall. Infection rates with polyester mesh is between 2% to 12% and polyester has the **highest biofilm formation rate**. Unprotected polyester mesh has not been recommended for intra abdominal placement as the fistula rate exceeds 15%.

The first expanded polytetrafluoroethylene (ePTFE) hernia repair biomaterial was introduced in 1983. ePTFE mesh is designed in either a perforated version is used for extraperitoneal and inguinal repairs or a solid version with two different sides. It is intended for intraabdominal use (**DualMesh).** The mesh that is made for intraabdominal use has a unique design. One side is smooth and microporous resists tissue ingrowth and is ideal to face or touch the intestine. The opposite side is rough has wider pores that allow intense tissue incorporation which is best for placement against the abdominal wall. This material conforms well to the abdominal wall has variable shrinkage and good long term compliance**. DualMesh Plus is the same ePTFE with one side that is impregnated with silver carbonate and chlorhexidine.** These two agents act synergistically and stop bacterial colonization of the device for 10 days after implantation.

Composite (or combination) mesh has increased in popularity. **These product layer more than one type of material to form composite mesh**, by which manufacturers attempt to make use of the various properties of biomaterial. Composite meshes are made **for intraabdominal use** with a protective non tissue ingrowth side facing the intestine and a tissue incorporating mesh over the abdominal wall. One product (Composix E/X) layers polypropylene and ePTFE over each

other. The ePTFE surface is positioned over the abdominal contents and serves as a protective interface over the bowel while the polypropylene faces the anterior abdominal wall to be incorporated into the peritoneum.

Other examples of these composite meshes contain an absorbable "nonstick" layer to a standard polypropylene or polyester. Such products include Proceed Parietex Composite and C-Qur which applies oxidized regenerated cellulose hydrocollagen or omega-3 fatty acids respectively to inhibit intestinal adhesions. The antiadhesive properties of coated meshes have shown reduced adhesion formation but not a complete resolution.

BIOLOGICS

The most rapidly changing feature of hernia surgery recently has been introduction of biologic tissue grafts. These prosthetics include both allograft and xenograft tissues. The basis for these products is decellularization and also protein stabilization process and it preserves the structural architecture of tissue of origin but removes the cells which could precipitate a foreign body reaction. These products essentially an acellular collagen implant allow remodeling by the host via native

fibroblasts and it migrates into the graft with subsequent collagen deposition.

They can be differentiated depending upon the tissue of origin or post harvesting processing techniques (i.e., cross linking sterilization and decellularization). Few peer reviewed scientific data are available to compare these grafts in a clean or clean contaminated ventral hernia repair. According to theory they provide a framework for native blood vessel incorporation and they are potentially resistant to infection. As they are expensive, they have been typically reserved for contaminated ventral hernia repair in which synthetic mesh is found to be contraindicated. These grafts do not result in a long term, durable hernia repair when used as a bridge across fascial defect. Typically maneuvers to achieve fascial closure and utilization of the graft as fascial reinforcement provide better results.

PRINCIPLES OF SURGICAL HERNIA REPAIR

The Mayo repair "vest over pants" was thought to be a great advance in the repair of incisional hernias which involves overlapping the layers of normal fascia and also securing with a double row of mattress sutures. But this is not an effective repair with recurrence rates

of upto 54% at 10 years which are similar to the rates of standard simple fascial reapproximation. The inability to place strong fascia in apposition without tension in hernia repairs prevented the Mayo repair from attaining universal success.

Even when small hernias less than 10 cm2 **repaired with suture, the recurrence rate was more than 40%. The recurrence rate was only 6% when mesh repair was done.** It is basic that large hernias require mesh implantation for an adequate repair. It appears that prosthetic use may be as important for small defects. The 10 year cumulative recurrence rate again shows a 50% reduction in recurrence of hernia if a prosthetic is used.

The standard use of prosthetic mesh as a bridge sewn to the fascial edge with minimal overlap might not be sufficient for every hernia repair. With this understanding repair of ventral hernia repair with attempts to medialize the rectus muscle was made. Although there is a consensus that most incisional hernia repairs should be reinforced with a prosthetic there continues to be a heavy debate as to the best approach to place the mesh**. The onlay technique involves primary closure of the fascial defect followed by reinforcement by placing the mesh prosthetic over the fascial repair.** Supporters of this technique promote the separation of the mesh from abdominal contents as a major advantage and it avoids

complications. The prosthetic mesh is secured to the anterior rectus sheath with the help of sutures or fascial staples.

The onlay technique has many disadvantages. Significant subcutaneous dissection may lead to devitalized tissue with **seroma formation or infection** is needed to place proper sized mesh. The superficial location of the mesh puts it in a danger of infection if there is superficial wound dehiscence. The primary repair is often under tension and it can contribute to **recurrence**. Ideally the transfascial sutures are placed before primary closure of the fascial defect so that to avoid the possibility of potential bowel injury that can occur if the sutures are placed blindly. Onlay technique when compared with placing the mesh in an underlay fashion was associated with five times increased recurrence rates and twice the rate of postoperative wound complications.

Early experience with prosthetic mesh involved placing it as an inlay secured to fascial edges. Given the eventual contraction of the mesh and the forces applied to the prosthetic, this approach resulted in a very high failure rate and has been largely abandoned. With the multiple mesh products currently available, mesh is now being placed in a sublay approach below the muscle. **The sublay technique involves the prosthetic being placed intraperitoneally preperitoneally or in the**

retrorectus submuscular space. Some of the understandings of ideal mesh placement were adopted from lessons learned from inguinal hernia repair and might not be applicable for ventral hernia.

The concept of tension free hernia repair became popular with inguinal hernia repair and was extended to ventral hernia repair. This led to the technique of bridging the defects with prosthetic mesh. However this option may not be the best for the anterior abdominal wall for all hernia sizes**. Contraction of the rectus and also lateral abdominal wall muscles that are not joined at the linea alba result in lateral displacement forces and thereby, a constant separating shear force is applied to prosthetic. Along with the incidence of shrinkage of most prosthetics this has resulted in a high recurrence rate at the tissue mesh interface.**

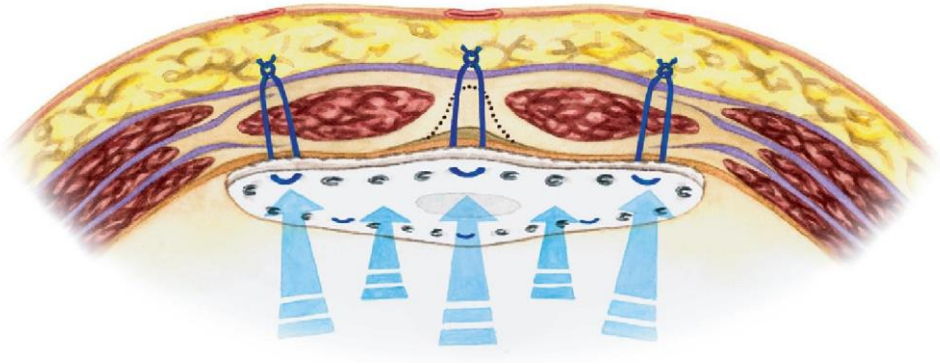
As such in the case of a hernia when the constant force is removed from the muscle the muscles develop pathologic disuse atrophy fibroses and changes in type of muscle fiber. Whether this can or cannot be reversed or improved with formal abdominal wall reconstruction is unknown at present time. The **French surgeons Rives and Stoppa revolutionized the hernia repair surgeries by introducing a retrorectus extraperitoneal repair with a large**

prosthetic.

The prosthetic is placed preperitoneally below the arcuate line or superficial to the posterior rectus sheath above the umbilicus. Transfascial sutures are placed in the mesh in order to secure the prosthetic to the fascia and redistribute the forces of the abdominal wall away from the midline closure to the lateral abdominal wall. In addition to a mesh repair the midline fascia is closed that restores the previously displaced abdominal muscle into a more anatomic and functional position. Drains are then placed above the prosthetic. This **method documented a recurrence rate from 5% to 14%.**

The advantages of placing a large mesh with significant overlap under the muscular abdominal wall can be explained by Pascal principles of hydrostatics. Because the intra abdominal cavity functions as a cylinder the pressure is uniformly distributed to all aspects of the system. Consequently the same forces that attempt to push the mesh through hernia defects are also holding the mesh in place against the intact abdominal wall. In this manner **the prosthetic is held in place by the intra abdominal pressure. The mechanical strength of the prosthetic prevents protrusion of the peritoneal cavity through the hernia because the hernial sac is indistensible against the mesh.** Over time,

the prosthetic is incorporated into the fascia and unites the abdominal wall, which is now without an area of weakness.



LAPAROSCOPIC OPERATIVE METHOD

Some principles of retrorectus prosthetic reinforcement have been adapted for laparoscopic ventral hernia repair. Instead of applying the mesh in a preperitoneal position **an intraperitoneal underlay with wide coverage of the hernia defect is done.** The mesh is secured in position with transfascial sutures and metallic staples or tacks. This technique also takes the advantage of Pascal principle of hydrostatics to provide a secure hernia repair. However it does not include closure of the fascial defect and reconstruction of the abdominal wall. Because of these limitations **laparoscopic ventral hernia repair might not be the ideal approach for complex and larger defects.**

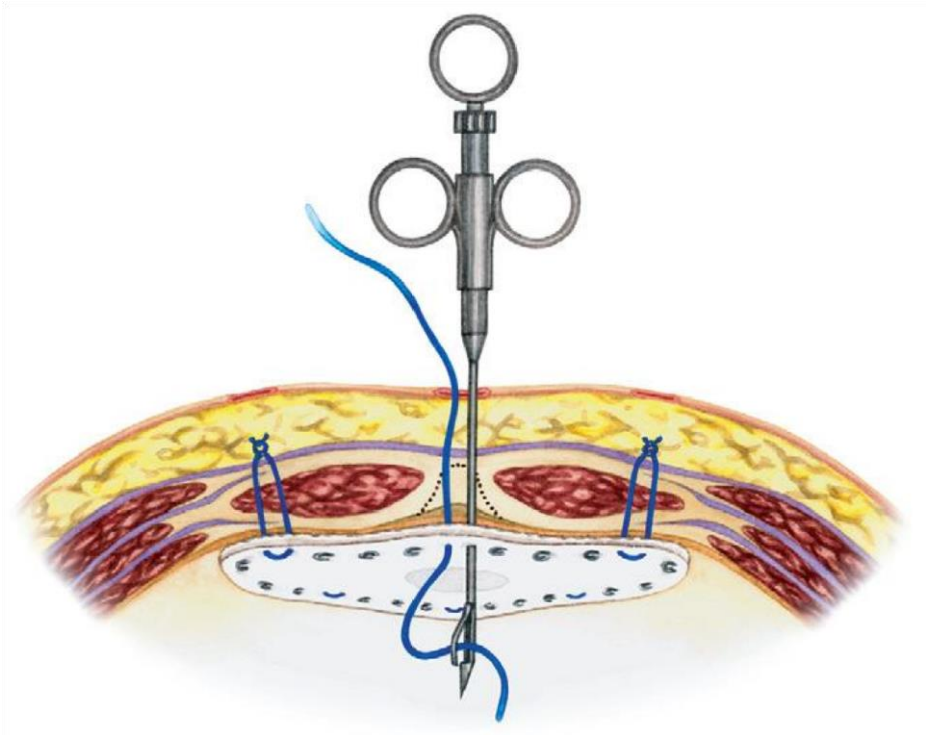
Laparoscopic ventral hernia repair is normally performed with a 30 or 45 degree angled laparoscope. A small number of laparoscopic bowel graspers dissectors scissors and blunt graspers are also necessary. Currently 5mm fixation devices (**spiral titanium or absorbable tacks)** are used. A suture passing device is used for full thickness transabdominal wall sutures. This approach requires the placing a intraperitoneal prosthetic in contact with the viscera. Numerous prosthetic meshes have been designed to be placed in the intraperitoneal position and take the advantage of antiadhesive barriers on one side of the mesh.

The first step in a laparoscopic ventral hernia repair requires establishment of pneumoperitoneum. This can be done safely using either an open abdominal access technique Veress needle or an optical viewing trocar. A window of access between the costal margin and the iliac crest on one side or the other is usually present even in a multiply operated abdomen. After inserting the first trocar the abdominal cavity is viewed and under direct visualization additional trocars are placed as far laterally as possible. Three trocars are placed on the operative side for an inline view and a two handed technique used for dissection and mesh deployment and fixation. One or two additional trocar on the contralateral side is sometimes required**. The most difficult and time**

consuming portion of the procedure is adhesiolysis. Very rare but serious complications from this procedure are related to bowel injury; hence meticulous dissection technique must be used. Sharp dissection should be performed as much as possible in order to avoid thermal spread from electrothermal (cautery) and ultrasonic energy.

Small bowel injuries during adhesiolysis can become catastrophic especially if they are missed. **Enterotomy has been reported in an average of 1.7% to 3.3% of patients in recent series of laparoscopic ventral hernia repair.** If an enterotomy occurs, the mortality rate is reported to be 1.7% even if it is recognized and repaired and **if the enterotomy is missed the mortality rate increases to 7.7%.** Management of a recognized intraoperative enterotomy varies according to the type and extent of the intestine injured and the type of mesh available. Small lacerations in the small intestine or bladder without significant contamination may not be an absolute contraindication to mesh placement either laparoscopically or by open means. In case of fecal spillage the bowel should be repaired and the adhesiolysis completed. A delayed hernia repair is generally advocated if a prosthetic is required.

The patient is usually placed on a regimen of antibiotics and returned to the operating room in 3 or 4 days for definitive repair if there are no signs of infection or the procedure may be altogether aborted. Other options include primary repair of the hernia defect anticipating higher recurrence rate or repair with a biologic mesh (although the long term durability of these repairs remains to be evaluated). Thus **placement of synthetic mesh in the presence of significant contamination is contraindicated.**



The hernia defect must be measured correctly to size the mesh prosthesis accordingly. This may be accomplished either externally or internally. If the hernia margins are measured externally the abdomen should be desufflated to more accurately delineate the actual size of the

hernia. Otherwise, a thick abdominal wall or large hernia can lead to overestimation of the mesh needed to fix the hernia. Measuring the hernia defect internally is performed with a disposable plastic ruler that is brought into the abdomen through a trocar. The length and width of the defect can be determined inside the abdominal cavity utilizing spinal needles as a guide. In this way the size of the hernia can be very accurately measured.

Whether obtained inside or outside the abdomen, these measurements are generally used to choose an appropriately sized prosthetic mesh and it will overlap all the margins of the defect by at least 4 cm. Four nonabsorbable size 0 monofilament or ePTFE sutures (approximately 30 cm in length) are placed at the midpoint on each side. Exit sites for sutures are predetermined on the abdominal wall and marked 4 cm or more beyond the margin of the hernia. The mesh is rolled like a scroll from the superior and inferior ends and is compressed and pulled into the peritoneal cavity through a 10 mm port site which is then unfurled within the abdomen.

The sutures are individually pulled through the abdominal wall with a suture passer at the positions marked previously. The individual strands of each suture are brought out through separate fascial punctures but through the same skin incisions such that full thickness abdominal

wall bites are taken to secure the mesh in position. The initially marked sites may need to be modified further radially to allow for taut placement of the mesh. It is important that the mesh should be taut when the abdomen is insufflated as to avoid mesh buckling and excessive bulging. The sutures are tied individually with the knots is buried in subcutaneous tissue. **Then the perimeter of the mesh is secured with spiral tacks or staples placed 1 cm or so apart. The tacks are positioned close to the mesh edge to prevent infolding of the mesh and exposure of the rough woven side to bowel.** The ideal number of sutures remains controversial. For small hernias or Swiss cheese type defects four sutures are likely to be sufficient. For larger central defects in obese patients more sutures are generally advisable. Additional full thickness nonabsorbable sutures are placed circumferentially in the mesh every 4 to 7 cm with the suture passer if necessary.

The tacks ensure bowel will not herniate between the sutures. They add some security to the repair however do not provide enough strength to serve as the only points of fixation. Recognizing this numerous absorbable fixation devices are currently available. Little data exist to show a reduction in pain or change in recurrence rates associated with these absorbable fixation devices. **Drains are not used for laparoscopic repairs traditionally.**

As more emphasis is placed on recreating a functional abdominal wall surgeons have investigated the ways to reapproximate the rectus muscles in the midline though minimally invasive approach. Although there is little more than case reports to describe this technique it involves placing interrupted figure of eight sutures with a suture passer through the displaced rectus. After placing enough sutures for the size of the defect (usually three to four) they are brought together under tension and tied bringing back the defect together in the midline. The defect is then reinforced with an intraperitoneal piece of mesh similar to the standard laparoscopic ventral hernia repair. Typically the mesh is sized as if the defect were left open. Undersizing this mesh might result in early reherniation if the defect is closed under excessive tension. Other authors have incorporated **endoscopic component separation for reducing tension on the midline closure for larger defects.** Only small series have evaluated this method in terms of hernia recurrence, but it brings together the principles of minimally invasive hernia repair and recreating a functional abdominal wall.

COMPONENTS SEPARATION AND MUSCLE FLAPS

Large incisional hernias mostly occur in patients who have experienced traumatic injuries or intraabdominal catastrophes and who

are at times left with an open abdomen. Damage control laparotomy and early recognition and treatment of abdominal compartment syndrome have improved survival but occasionally patients are left with massive ventral hernias because the fascia is not amenable to be reapproximated. Subsequent skin closure alone or skin grafting directly to granulating abdominal viscera provides coverage. Over time the musculature of the anterior abdominal wall though present anatomically, retracts laterally and enlarges the hernia. The defects remaining after excision of the skin grafts are often not amenable to primary closure and prosthetic closure may be difficult as well.

In addition these cases have a high incidence of fistula formation and infection that complicates prosthetic placement. A similar cohort of patients with large (often recurrent) ventral incisional hernias presents similar reconstructive challenges for which several innovative approaches of local tissue transfers have been developed. Native tissue transfer is a possibility for closure of these wounds**. A vascularized and innervated muscle flap is ideal for maintaining viability of the abdominal wall.**

Free flap tissue transfer has been used for this repair but it may include the morbidity of the donor site in addition to potential vascular

flow issues that can lead to flap necrosis. The flap is also denervated and this leads to muscular atrophy and laxity in the new site which are not ideal properties for abdominal hernia repair. Tissue expanders under the external oblique can be useful. However they require an additional surgical procedure and the device requires a prolonged expansion phase and is associated with an inherent risk of infection expander extrusion and failure. These expanders provide more reliable skin expansion than fascial expansion. The ideal timing of this procedure depends on certain patient factors.

These complex reconstructive procedures should be delayed until complete healing of the abdomen has occurred and the overlying skin or graft is freely mobile from the underlying viscera which requires 6 to 12 months typically. Another benefit of delayed repair is to permit the most intense part of the inflammatory response to resolve and allow softening of the intraabdominal adhesions. These techniques require a mobile compliant lateral abdominal wall to provide maximal advancement. **Aggressive nutritional support to achieve preillness status is also necessary.**

Components separation techniques have been developed to provide a tension-free abdominal wall repair. The first goal in this

technique is to access the abdominal cavity and lyse the necessary adhesions. Adhesions to the anterior abdominal wall skin or grafts should be cleared laterally to anterior axillary line. Though interloop adhesions need not be divided any omentum that can be freed can be used later to protect the bowel from a prosthetic if one is required.

Abdominal skin graft if present is excised. Depending on the density of the adhesions this initial phase of the operation can be lengthy. However, complete adhesiolysis to the lateral abdominal gutters provides essential mobility of the lateral abdominal wall musculature for subsequent myofascial advancement.

Once adhesiolysis is complete mobilization of the muscle or fascial flaps (or both) is started. According to Ramirez et al, the initial release is performed to the posterior rectus fascia which is incised just lateral to the linea alba. The muscle can then be freed from the posterior fascia while taking care to preserve the blood supply (inferior epigastric vessels) that enters posterior near the lateral portion of this muscle**. In most moderatesized hernia, a posterior rectus release will achieve adequate mobilization for fascial closure.** Interestingly this technique is very similar to a Rives Stoppa repair. In that cases requiring additional advancement, an external oblique release is performed.

The basic tenets of the external oblique release are to gain access to the lateral abdominal wall muscles and incise the external oblique fascia 2 cm lateral to the linea semilunaris. The release is performed from the inguinal ligament to several centimeters above the costal margin. The external and internal oblique muscles are separated in their avascular plane upto the posterior axillary line. The blood supply to the external oblique muscle enters between the posterior and anterior axillary line. therefore dissection medial to this point does not endanger the neurovascular bundle. The external oblique release can be performed using a variety of modifications. Traditionally an open anterior approach involves creation of a large lipocutaneous flap. Alternatively a perforator sparing technique can be performed which involves preserving the periumbilical perforator vessels when creating skin flaps which has been reported reduced skin flap ischemia and

necrosis.

Another recent modification by Carbonell et al describes a posterior component separation, which is performed without a skin flap and involves release of the posterior rectus muscle to the linea semilunaris. The lateral abdominal wall is accessed through a release of the transversus abdominis muscle. the intermuscular plane in between the

transversus abdominis and internal oblique is developed to the posterior axillary line. This procedure is typically reinforced with synthetic mesh. The main disadvantage of this technique is that innervation of the rectus muscle is often sacrificed that may result in atrophy and weakness. However this approach provides the primary advantage of placing a large prosthetic in a sublay position without needing for large skin flaps. In an effort to further minimize the morbidity from the skin flaps required to access the lateral abdominal wall, a minimally invasive component separation technique has been described which involves a direct cutdown through the external oblique muscle just below the costal margin.

Using a laparoscopic balloon dissector the avascular plane is created between the external oblique and internal oblique muscles. Under laparoscopic guidance, the external oblique muscle is cut lateral to the semilunar line in a similar manner to open component separation. In an animal model, this approach has been reported to achieve 86% of the release of standard open component separation. Hernia recurrence after this operation has been shown to be 32% in infected and contaminated ventral hernia repairs. Wound complication rates range from 5.7% to 33%.

The components separation technique offers ventral hernia repair to patients who have complicated courses and in whom prosthetics are contraindicated. Although the presence of infection and fistula add morbidity to this patient population many patients can undergo abdominal wall reconstructions successfully. Perhaps, the ideal approach for ventral hernia repair would include an entirely minimally invasive abdominal wall reconstruction. Small series in selected cases have reported encouraging early results with this approach. For choice patients this would entail endoscopic component separation laparoscopic adhesiolysis laparoscopic defect closure and prosthetic deployment.

POSTOPERATIVE CONSIDERATIONS

Small hernia repairs may be performed on an outpatient basis but larger repairs require inpatient stay and occasionally intensive care unit monitoring. **In both open and laparoscopic surgery early ambulation is encouraged and emphasized for resolution of atelectasis reduction of venous stasis resumption bowel motility and general recovery.** The use of a first or second generation cephalosporin perioperatively is recommended for up to 24 hours postoperatively. Routine deep venous thrombosis prophylaxis is started before surgery with sequential compression devices and low molecular weight heparin is continued in

the postoperative period. A patient controlled analgesia device is quite useful until the patient can be transitioned to oral analgesics. Postoperative pain when an open retrorectus or laparoscopic repair has been performed is usually noted at sites of full thickness transfascial sutures. Persistent suture site discomfort (lasting 2 to 4 weeks postoperatively) may be treated effectively by subfascial

injection of a local anesthetic.

Its efficacy is a result of the anesthetic's ability to block the affected nerve signal temporarily, that allows the hypersensitivity to subside. Few patients complain of this problem in the long term and rates after laparoscopic repair range from 2% to 4%. With the recent advent of minimal access techniques and increased patient expectations surgeons pay greater attention to even minor incisional discomfort and ways to prevent and treat it.

Seromas develop in many patients undergoing ventral

herniorrhaphy regardless of whether a laparoscopic or open approach is performed. **In open surgery the placement of drains has been found to reduce seroma formation.** Seromas are common but rarely require intervention. Seromas are ubiquitous in the early postoperative period after laparoscopic ventral herniorrhaphy. **Expectant management is the preferred approach to all asymptomatic seromas. Aspiration of fluid is reserved for patients with significant or persistent symptoms, or if there is a serious doubt regarding infection. Longterm problems associated with seromas are rare.**

Open surgical techniques including large abdominal incisions wide tissue dissection with the creation of large flaps, and placement of a prosthetic (foreign body) result in a 12% to 18% wound complications rate after open prosthetic repair. **The laparoscopic approach to incisional hernias has dramatically reduced the wound-related morbidity.** The consequences of mesh infection are severe regardless of how the prosthetic was originally placed.

Traditional surgical teaching has advocated removal of contaminated or exposed prosthetics even though the morbidity associated with resection is high. Mesh removal almost always results in

recurrence, an open wound, and a larger hernia which will require reoperation. Fortunately, mesh removal is not mandatory always. **Infected polypropylene polyester and ePTFE mesh is capable of being salvaged with a combination of i.v antibiotics, local wound debridement, vacuum assisted closure, and subsequent soft tissue coverage of the granulated mesh.** Percutaneous drainage followed by antibiotic irrigation is a potential alternative to prosthetic removal.

UMBILICAL HERNIA

Repair of umbilical hernia which was described by William Mayo's vertical fascial overlap technique. This operation (or simple fascial closure) is still performed frequently by many surgeons. These repairs are effective and may be the preferred technique for small umbilical hernias with no tension after fascial approximation but larger hernias have been reported to have a recurrence rate of up to 28%. The introduction of mesh prosthetics has appropriately had an impact on umbilical hernia repair also. These tension free repairs which have been popularized for other ventral hernias may have a role in umbilical hernia repair.

There is no difference in complication rates associated with mesh use and in favor of mesh and supports the use of mesh in reducing umbilical hernia recurrence. The most ideal technique for placement of a prosthetic during umbilical hernia repair remains debatable. Laparoscopic techniques are present for umbilical hernias as well. The technical aspects are the same as those applied for other ventral hernia defects. The laparoscopic approach takes longer to perform tends to have fewer complications and has no recurrences.

Criticism of the laparoscopic approach includes the need for general anesthesia to establish pneumoperitoneum and increased length and cost of operating time. Placement of trocars around but not through the umbilicus has the potential to avoid the wound related

complications associated with an incision directly over the mesh. There are many effective methods to repair umbilical hernias. Patients must be individualised and one method of repair may not apply to all cases. Small primary umbilical defects in low risk patients can be repaired with sutures alone and achieve acceptable results. As the size of the defect increases particularly in obese patients a mesh prosthetic should be considered. Whether the repair is better performed via an open or laparoscopic approach is controversial as prospective data are not

available. Advancements in mesh prosthetics continues to guide the ideal approach.

SPIGELIAN HERNIAS

Adriaan van der Spiegel a Belgian anatomist was the first to describe the semilunar line as a concave region at the lateral border of the rectus muscle formed by the aponeurosis of the internal oblique.

More than 100 years later in 1764 Klinkosh identified the hernia of the Spigelian line as a distinct entity. Though spigelian hernias are rare (0.1% to 2% of all abdominal wall hernias), its diagnostic incidence has been rising because of improved imaging technology and incidental identification during laparoscopy. Spigelian hernias usually occur in the sixth and seventh decades and affect equally both sexes and sides. Most of them are acquired and almost 50% of patients with spigelian hernias have a history of previous laparotomy or laparoscopy.

Other factors that have been implicated to contribute to the development of these hernias are alterations in compliance of the abdominal wall as a result of morbid obesity multiple pregnancies prostatic enlargement chronic pulmonary disease and rapid weight loss in obese patients. A spigelian hernia is a challenge to diagnose which requires a high index of suspicion. Pain is the most common initial complaint. The fascial defect is masked by the intact overlying external oblique aponeurosis complicating physical examination. In addition, a

palpable mass when present may mimic an abdominal wall lipoma or desmoid tumor.

Although abdominal imaging may be helpful the findings of unusual abdominal complaints in the proper anatomic location should alert the clinician to the possibility of a spigelian hernia. Nevertheless more than 50% of spigelian hernias are diagnosed intraoperatively.
Given the narrow neck of these hernias 20% to 30% require emergency intervention. Therefore any incidental spigelian hernias should be repaired electively to avoid incarceration. Surgical management of these hernias has typically been accomplished via a transverse incision and primary repair. Primary repairs have been associated with a low but a recurrence rate of about 4%. As expected mesh repairs have been successfully applied to manage spigelian hernias. Fewer or no recurrences at long term follow up have been reported by investigators. More recently laparoscopic repair of spigelian hernias has also been reported. Evidence based surgical recommendations are limited by the rarity of this condition and a recommendation regarding suture or mesh based repair (either open or laparoscopic) is not clear at present time for the treatment of spigelian hernias.

SUPRAPUBIC HERNIA

The abdominal oblique aponeurosis rectus abdominis musculature and rectus sheath all insert on the symphysis pubis. Suprapubic hernias result from disruption of these musculotendinous elements of the lower abdominal wall and frequently occur after blunt abdominal trauma or pelvic surgery. The origin of traumatic suprapubic hernias is mostly through a ruptured rectus muscle at or near its insertion to the pubic bone. In contrast incisional suprapubic hernias develop as a result of apical pubic osteotomy or iatrogenic detachment of the rectus muscle from its pubic insertion to improve visualization during pelvic surgeries. Inadequate tissue purchase inferiorly during closure may result in hernia formation although infection and other patient factors may also contribute .

Radical prostatectomy is the most common procedure that leads to the development of a suprapubic defect. Similar defects are also seen after operations involving the uterus urinary bladder and sigmoid colon. Suprapubic hernias may manifest as vague lower abdominal discomfort urinary symptoms such as frequency or a palpable mass. The diagnosis may be missed because of the similarity of features with more common inguinal hernias. However a thorough physical examination will

demonstrate close proximity of the mass defect or both to the pubis not the external inguinal ring. Although suprapubic hernias may be a source of significant abdominal pain bowel incarceration requiring emergency repair is an extremely rare scenario. Primary repair of traumatic suprapubic hernias may be a good

alternative if the herniorrhaphy is undertaken without delay.

With time the rectus muscle retracts and can lead to significant tension if a primary repair is performed. Thus mesh repair is preferred for most traumatic and incisional suprapubic hernia repairs. Several approaches to mesh placement for suprapubic hernias have been described. The open preperitoneal approach provides an excellent delineation of the bladder and pubis and allows for appropriate inferior fixation of the mesh in contrast to an onlay style of repair. The laparoscopic approach to suprapubic herniorrhaphy also allows for a definitive repair.

This approach does require mobilization of the bladder much as in a trans abdominal preperitoneal inguinal hernia repair which can be facilitated by using a three way Foley catheter. The bladder is instilled with 300 mL of normal saline and can be clearly visualized for adequate mobilization to expose the entire pubis, Cooper ligament, and the iliac

vessels. This is imperative to prevent inadequate overlap of the mesh and also early recurrence. Regardless of the approach (open or laparoscopic) the dissection can be complex because of the close proximity of these hernias to bony, vascular, and nerve structures, and importantly the bladder.

MATERIALS AND METHODS

MATERIALS AND METHODS

Aims and Objectives

To study and compare the various approach in the surgical management of ventral hernia namely onlay, sublay and laparoscopic intraperitoneal mesh repair.

Study Centre

Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai

Duration of Study

May 2015 to October 2015

Study Design

Prospective & Observational study

Sample Size

Total no of patients: 60 In 20 pts mesh was placed overlay , 20 patients preperitoneal, 20 patients intra abdominal.

Based on defect size

3 classifications was made

<4 cm - 18 patients, 6 in each group

4.1-7 cm - 21 patients, 7 in each group

7.1-10 cm - 21 patients, 7 in each group

Inclusion Criteria

· Patients admitted in the department of general surgery and diagnosed to have ventral hernia clinically.

· Patients who would be informed about the study; would have read, understood and signed the patient informed consent and would be willing to submit to postoperative follow-up and evaluations.

Exclusion Criteria

· Age less than 18 or above 70 years.

· Inguinal, femoral, obturator, parastomal and lumbar hernias are not included in study.

· Patients with peritonitis are not included in study.

· Strangulated hernias are not included in the study.

· If the patient do not sign the consent form.

Patients who have already undergone mesh repair for ventral hernia are not included in study.

Investigation Details

Patients will be subjected with baseline investigations (CBC, LFT, RFT), urine routine, CXR, ECG.

Methodology

60 patients presenting to Rajiv Gandhi Govt General Hospital between May 2015 to October 2015 and falling into selection criteria was randomized into three groups, one undergoing onlay mesh placement and other undergoing sublay placement of mesh and other undergoing intraperitoneal placement of mesh in ventral hernia surgery with equal number of patients in each group. All patients was investigated with previously mentioned investigations. Patients falling into the selection criteria and given consent for study were included in the study. Anaesthetic fitness was obtained and the patients were randomized into study groups based on defect size. All patients received the same pre operative antibiotics and post operative management. The surgery was conducted in a standard operating room with strict aseptic precautions. Gloves was changed before placing the mesh.

Open repair

Under strict aseptic precautions parts painted and draped. Skin incision was made according to the type of hernia. Subcutaneous tissue was opened. Sac was identified and dissected all around. Sac was opened and adhesions were released. Excess sac was removed and the defect was sutured with 1 proline. Now flaps were raised and plane was created above rectus sheath for the deployment of mesh. Proline Mesh was anchored to rectus sheath with 2-0 proline. The size of the mesh was decided as according to give a coverage of 5 cm all around the defect so as to compensate for the post operative shrinkage of the mesh.

Romovac suction DT was placed under the flaps and anchored to skin. Subcutaneous tissue and skin was closed.

Preperitoneal repair

Under strict aseptic precautions parts painted and draped. Skin incision was made according to the type of hernia. Subcutaneous tissue was opened. Sac was identified and dissected all around. Sac was opened and adhesions were released. Excess sac was removed and the peritoneum was closed. Now plane was created in the preperitoneal plane for the deployment of mesh. Proline mesh of appropriate size to give a coverage of 5 cm all around defect was placed and anchored to peritoneum with 2-

0 proline. Care was taken to avoid taking bites into the underlying bowel. Romovac suction DT was placed and anchored to skin. Now the rectus sheath was closed with 1 proline. Subcutaneous tissue and skin was closed.

Laparoscopic repair

Under strict aseptic precautions, parts painted and draped. Veress needle was inserted and pneumoperitoneum created. According to convenience and safety 10 mm camera port was introduced. Another two 5 mm working ports were introduced location based on principles of laparoscopy. Adhesions to the defect was released taking care not to injure bowel. Physio or proceed mesh of appropriate size giving a 5 cm coverage all around defect was introduced and anchored both with sutures and tackers. Pneumoperitoneum was released and ports were removed. Rectus closed with 1 proline. Skin was closed.

All 3 groups were observed post operatively for day of ambulation, postoperative pain, seroma, wound infection, duration of hospital stay and followed up for return to work. The data was analysed.

OBSERVATION AND ANALYSIS

OBSERVATION AND ANALYSIS

Out of the total no. of patients studied, 66% were females, 34% were males

Age distribution

21 to 30 – 5%

31 to 40 – 30%

41 to 50 – 35%

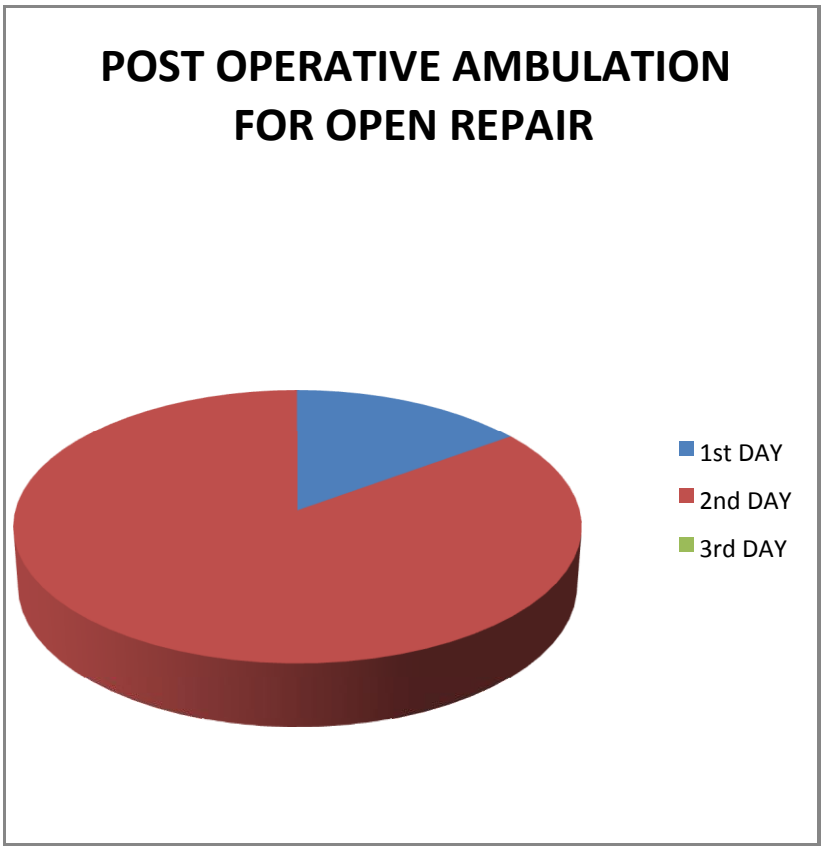
51 to 60 – 25%

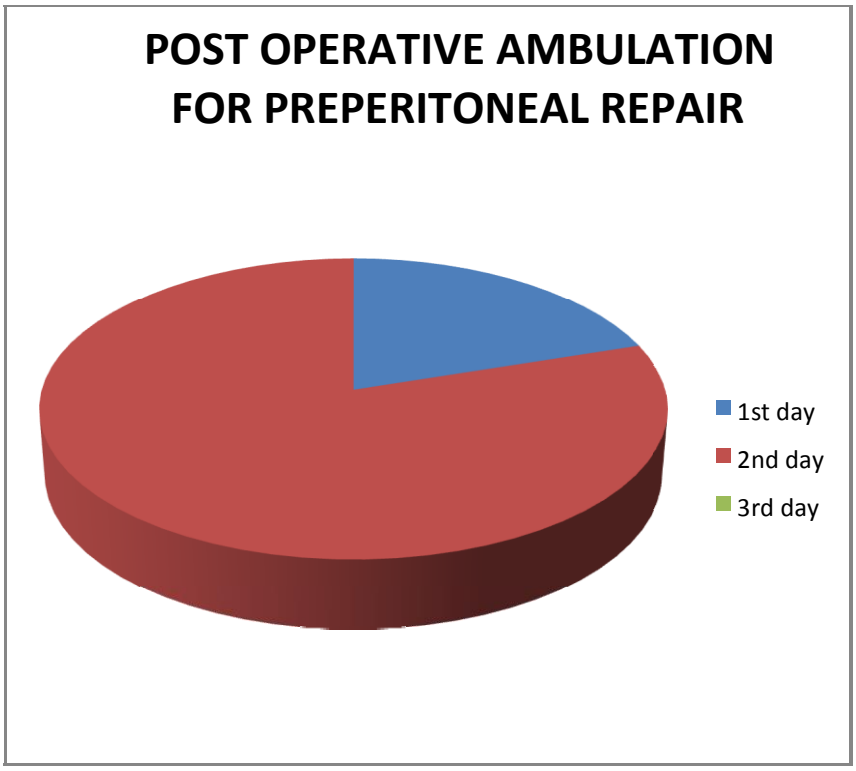
>61 - 5%

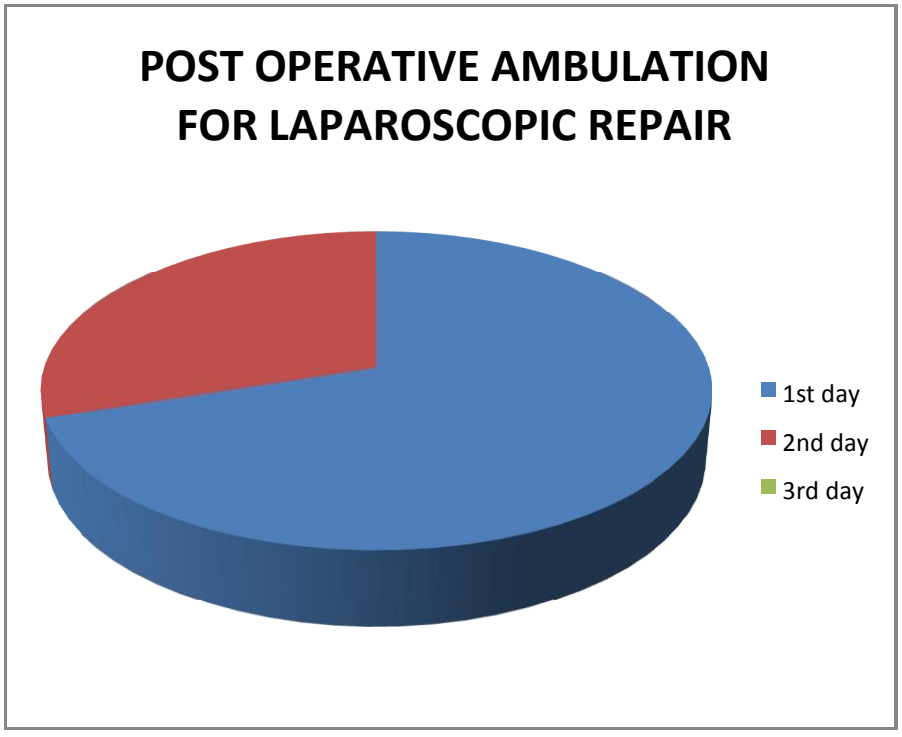
POST OPERATIVE AMBULATION

	1 DAY	**2 DAY**	**3 DAY**	**TOTAL**
OPEN	3	17	0	20
PREPERITONEAL	4	16	0	20

LAPAROSCOPIC	14	6	0	20



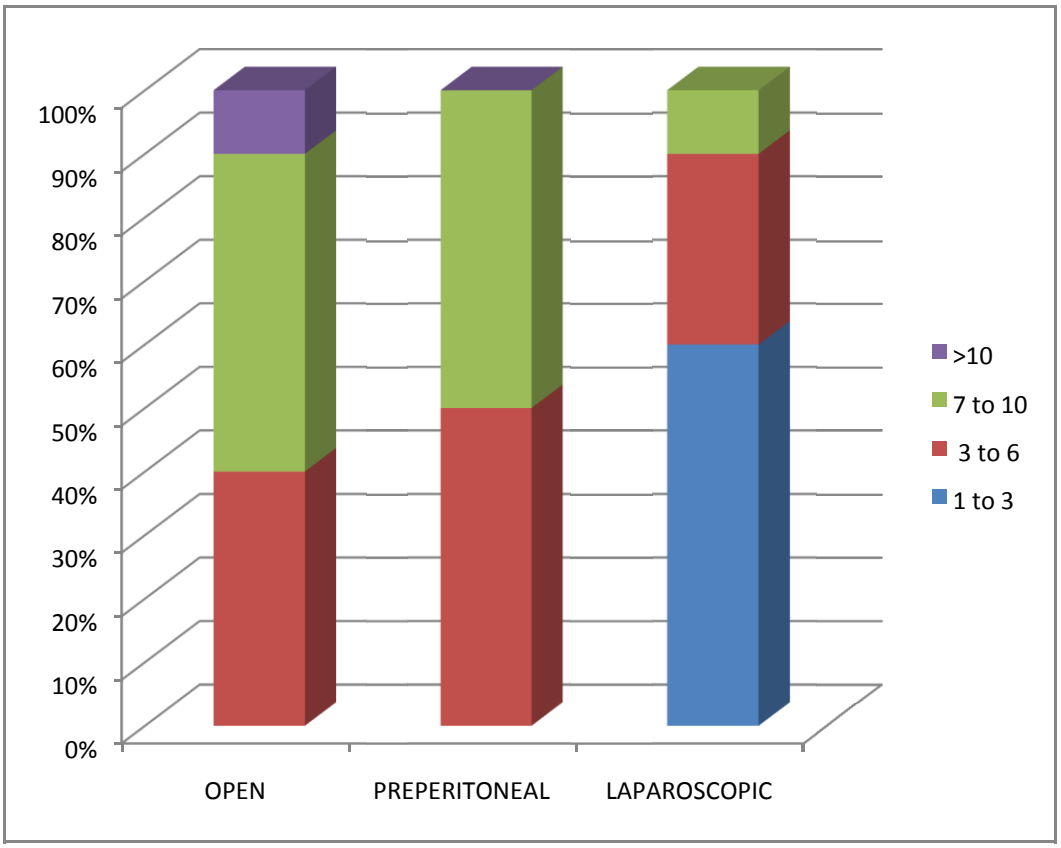

POST OPERATIVE AMBULATION
FOR PREPERITONEAL REPAIR
1st day
2nd day
3rd day


POST OPERATIVE AMBULATION
FOR LAPAROSCOPIC REPAIR
1st day
2nd day
3rd day

This comparison shows that postoperative ambulation is earlier in case of laparoscopic repair followed by preperitoneal followed by open repair.

DURATION OF HOSPITAL STAY

	OPEN	**PREPERITONEAL**	**LAPAROSCOPIC**
1-3	0	0	12
4-6	8	10	6
7-10	10	10	2
>10	2	0	0



This comparison shows that duration of hospital stay on average is

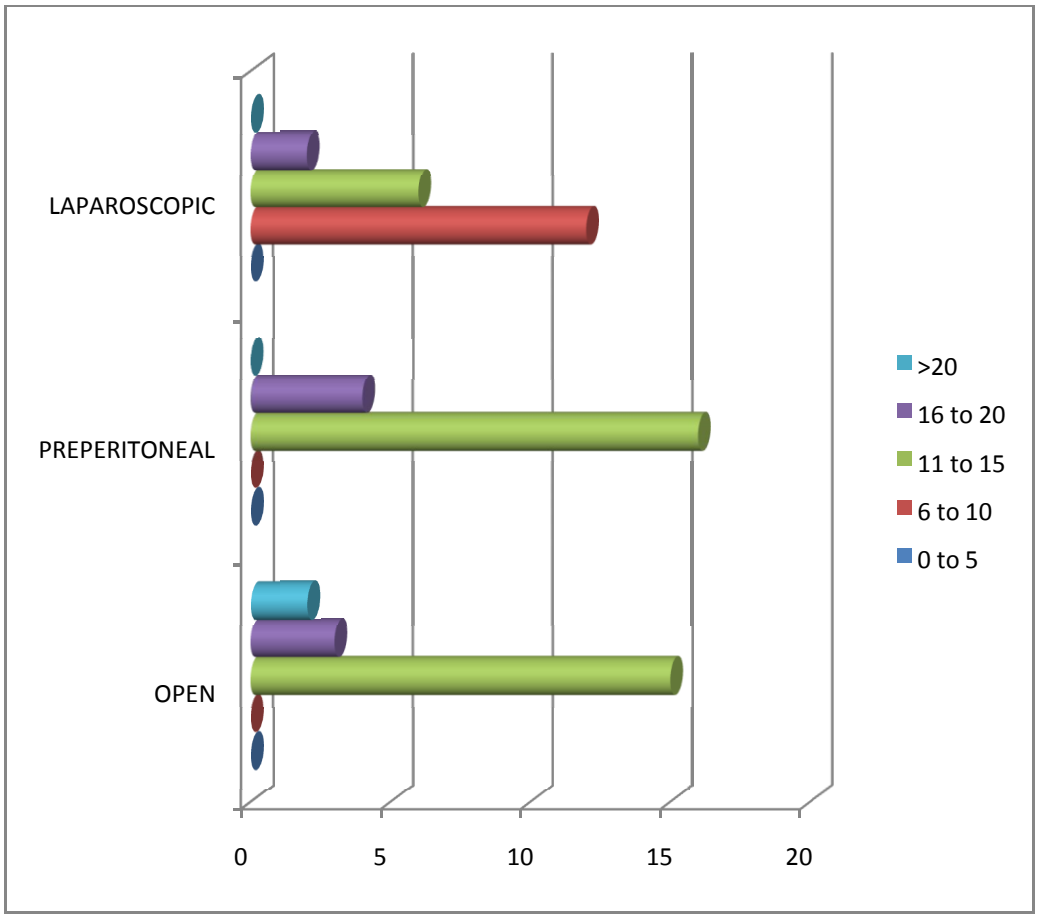
· For open repair – 7 days

· For preperitoneal repair – 6 days

· For laparoscopic repair – 3 days

RETURN TO WORK

DAYS	OPEN	PREPERITONEAL	LAPAROSCOPIC
0 – 5	0	0	0
6 - 10	0	0	12
11 - 15	15	16	6
16- 20	3	4	2
>20	2	0	0



This comparison shows that the mean time to return to work

· For open repair - 13 days

· For preperitoneal repair – 12 days

· For laparoscopic repair – 9 days

POST OPERATIVE COMPLICATIONS

	OPEN	**PREPERITONEAL**	**LAPAROSCOPIC**
PAIN >2 DAYS	3(15%)	3(15%)	2(10%)
SEROMA	4(20%)	1(5%)	0
WOUND INFECTION	3(15%)	1(5%)	0

DISCUSSION

DISCUSSION

· Incidence of ventral hernia greater among females(65%)

· Incidence greatest in the age group of 40 to 50 years

· Time duration , cost of surgery, cost of mesh, technical expertise required higher in case of laparoscopic repair.

· Regading post operative ambulation,

1. Open repair - 15% ambulate on day 1, 85% on day 2

2. Preperitoneal repair- 20% ambulate on day1, 80% on day 2

3. Laparoscopic repair – 70% ambulate on day1, 30% on day 2

Postoperative ambulation plays an important role in the recovery of the patient. hence postoperative recovery is quick in case of laparoscopic repair group.

· Regarding duration of hospital stay,

1. Open --40% 4 - 6 days, 50% 7- 10 days, 10% greater than 10days

2. Preperitoneal –50% 4-6 days, 50% 7- 10 days

3. Laparoscopic – 60% 1- 3 days, 30% 4- 6 days, 10% 7-10 days

· Regarding return to work post surgery

1. Open – 75% 11 – 15 days, 15% 16- 20 days, 10% > 20 days

2. Preperitoneal – 80% 11 – 15 days, 20% 16 - 20 days

3. Laparoscopic – 60% 6-10 days, 30% 11- 15 days, 10% 16- 20 days

Hospital stay and return to work after surgery plays an important role in the mindset of the patient towards the illness, regarding the treatment , regarding the surgery and so on. It is better in case of laparoscopic repair.

· Regarding post operative complications

1. Pain>2 days – open 15%, preperitoneal 15%, laparoscopic

10%

2. Seroma – open 20%, preperitoneal 5%, laparoscopic – nil

3. Wound infection – open 15%, preperitoneal- 5%, laparoscopic –nil.

CONCLUSION

CONCLUSION

- In aspects of patient comfort such as postoperative ambulation, hospital stay and return to work, laparoscopy is better than other two methods. Among the other two methods preperitoneal repair is slightly better than open type repair of ventral hernias

- In aspects of postoperative complications such as postoperative pain, seroma formation and wound infection, laparoscopy gives best result followed by preperitoneal repair followed by open repair.

- However laparoscopy is associated with increased cost for the patient. And also expertise required by the surgeon should be appropriate which is high in case of laparoscopy. In inexperienced hands it is associated with a lot of complications

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PROFORMA

QUESTIONAIRE

PATIENT DETAILS:

Name: Age: Sex:

IP No. :

ON ADMISSION:

Main Complaints :

Duration of Complaints :

Co – Morbid Illness :

Significant Past History :

CLINICAL EXAMINATION:

Pulse : BP :

RR : Temp :

Pallor : Icterus :

RS :

CVS :

P/A :

INVESTIGATIONS :

CBC: ESR:

Liver Function Test : Renal Function Test :
CXR :

USG Abdomen

TREATMENT :

Intra – op Findings.

FOLLOW UP :

Post operative pain score on Day 3:

Seroma or wound infection if any:

Other complications

Day of ambulation:

Day of discharge:

Day of return to work:

MASTER CHART

S.NO.	NAME	AGE/ SEX	IP NO	DEFECT SIZE	TYPE OF REPAIR	PAIN>2 DAYS	SERO MA	WOUND INECTION	POST OPERATIVE AMBULATION	DURATION OF HOSPITALIS ATION	RETURN TO WORK
1.	Shanthi	34/F	68128	3	Open	no	no	no	1	4	11
2.	Malar	39/F	69458	8	Preperitoneal	No	No	No	2	7	16
3.	Thanikachalam	25/M	69701	5	Laparoscopic	No	No	No	1	2	8
4.	Babyammal	34/F	69783	8	Laparoscopic	No	No	No	2	5	14
5.	Kutty	51/F	69901	2.5	Open	no	no	no	2	5	13
6.	Nooriahan	36/F	69992	3.5	Open	no	no	no	2	5	11
7.	Syed ismail	50/M	70103	3	Preperitoneal	No	No	No	1	6	14
8.	Saroja	49/F	72908	5.5	Open	no	no	no	2	4	12
9.	Nagappan	31/M	73001	5	Open	no	no	no	2	7	11
10	Vijaya	37/F	73928	3	Laparoscopic	No	No	No	1	3	9
11	Padma	43/F	74301	6	Open	no	no	no	2	8	14
12	Pushpa	53/F	74821	6.5	Open	no	no	no	2	7	14
13	Ibrahim	35/M	75001	7.5	Preperitoneal	No	No	No	2	7	11
14	Ganesan	62/M	75604	9	Open	No	no	yes	2	9	17
15	Madhammal	50/F	75923	7	Open	no	no	no	2	9	13
16	Mangalakshmi	39/F	76123	8	Laparoscopic	No	No	No	2	5	12
17	Elumalai	49/M	76298	7.5	Open	no	yes	no	2	8	12
18	Kuberan	39/M	76989	8.5	Preperitoneal	No	No	No	2	8	14
19	Noor nisha	58/F	77356	8.5	Open	no	yes	no	2	7	13
20	Sevandhi	48/F	77689	4.5	Preperitoneal	No	No	No	2	9	14
21	Malliga	59/F	77987	9.5	Open	Yes	no	yes	2	13	21
22	Arumugam	45/M	78102	9	preperitoneal	Yes	no	yes	2	13	20
23	Kondiappan	47/M	78358	9	Preperitoneal	yes	yes	no	2	11	18
24	Saroja	64/F	78906	4.5	Open	no	no	no	2	6	11
25	Selvi	45/F	79325	8.5	Preperitoneal	yes	no	no	2	9	16
26	Maruthappan	52/M	79913	9.5	Open	yes	yes	no	2	10	19
27	Krishnan	32/M	80245	8	Preperitoneal	No	No	No	2	8	13
28	Chitra	36/F	80901	5.5	Preperitoneal	No	No	No	2	7	11
29	Jayanthi	56/F	81954	8	Open	No	yes	no	2	8	18

30	Kanchana	59/F	82302	5	Preperitoneal	No	No	No	2	8	12
31	Manohar	70/M	82879	4	Open	no	no	no	1	4	11
32	Usha	26/F	83657	6.5	Preperitoneal	No	No	No	2	4	11
33	Rajeshwari	55/F	83712	4	Preperitoneal	No	No	No	2	4	11
34	Kamala	34/F	84002	7.5	laparoscopic	No	No	No	2	6	13
35	Purushothaman	48/M	84305	3	Preperitoneal	No	No	No	2	5	12
36	Saranya	41/F	84808	8.5	Laparoscopic	No	No	No	2	5	12
37	Mohan	40/M	85019	3.5	Preperitoneal	No	No	No	1	4	11
38	Durga	50/F	85509	4	Preperitoneal	No	No	No	1	5	12
39	Dharani	51/F	85698	4	Laparoscopic	No	No	No	1	2	6
40	Mangamma	31/F	86245	3	Laparoscopic	No	No	No	1	1	7
41	Nagaraj	25/M	86390	3	Open	no	no	no	2	6	13
42	Jayaraman	54/M	86900	2.5	Laparoscopic	No	No	No	1	3	6
43	Maheshwari	41/F	87401	3.5	Laparoscopic	No	No	No	1	2	8
44	Anandhi	32/F	87720	2.5	Preperitoneal	No	No	No	1	6	13
45	Jayanthan	53/M	88201	4	Laparoscopic	No	No	No	1	2	6
46	Ranganayaki	49/F	88567	6.5	Laparoscopic	No	No	No	1	3	7
47	Malaryannan	33/M	88658	7	Preperitoneal	No	No	No	2	6	12
48	Gnanamani	42/M	88981	6	Laparoscopic	No	No	No	1	1	6
49	Kuliammal	46/F	89011	5.5	Laparoscopic	No	No	No	1	3	7
50	Veerappan	57/M	89102	8	Open	Yes	no	yes	2	16	24
51	Rani	47/F	89320	5	Laparoscopic	No	No	No	1	2	8
52	Deepa	35/F	89430	5	Open	no	no	no	2	10	15
53	Maheshwari	42/F	89648	4.5	Laparoscopic	No	No	No	1	3	9
54	Parvathy	43/F	89715	6.5	Laparoscopic	No	No	No	1	4	11
55	Ponnamma	52/F	89802	6	Preperitoneal	No	No	No	2	8	12
56	Rafat jahan	29/F	89925	7.5	Laparoscopic	No	No	No	1	6	13
57	Reetha	54/F	89995	3.5	Open	no	no	no	1	5	12
58	Uma	45/F	90034	8	Laparoscopic	Yes	No	No	2	8	17
59	Padma	53/F	90295	4.5	Preperitoneal	No	No	No	2	9	15
60	Vijaya	41/F	90450	8.5	Laparoscopic	Yes	No	No	2	9	18